A New Species (with Subspecies) of Fossil *Oreohelix* from New Mexico

(Gastropoda : Pulmonata : Oreohelicidae)

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(1 Plate)

INTRODUCTION

Described herein is a species, with three subspecies, of a fossil pulmonate land snail of the genus *Oreohelix*. The snails described occur in Pleistocene deposits of the Sacramento Mountains, Otero and Lincoln counties, New Mexico. This mountain range is some 100 km long, north to south, and 70 km wide, east to west. The mountains are block-faulted and tilted, with steep scarps to the west but with slopes of lower gradient to the east. The north-south trending crest of the range maintains elevations of 2775-2925 m. Forests occur generally above 2400 m elevation. Bedrock is mainly of limestones and shales of Pennsylvanian and Permian age. Pleistocene deposits are common as alluvial fill in canyons and as colluvium on hillslopes. Northward, the Sacramento Mountains merge, topographically, with the White Mountains, which comprise two major peaks, Sierra Blanca to the south and Nogal Peak to the north. The White Mountains attain higher elevations than the Sacramentos and are formed on igneous bedrock.

Localities of collections are indicated hereafter. Abbreviations used in designating repositories of types are: ANSP: The Academy of Natural Sciences of Philadelphia; DMNH: Dallas Museum of Natural History; UA: University of Arizona; USNM: National Museum of Natural History; UTEP: University of Texas at El Paso.

Oreohelicidae Wurtz, 1955

Oreohelix Pilsbry, 1904

Oreohelix ***oterana*** Metcalf, spec. nov.

Diagnosis: A large *Oreohelix* with relatively smooth shell, embryonic whorls with very low contour and smooth dorsally, bearing only low growth wrinkles on first 1.5 whorls and a few microspiral ridges on whorls 1.5-3.0; embryonic shell lirate ventrally; first few whorls keeled; narrow brownish bands present.

Considerable variation exists among populations of fossils. This variation has been dealt with by erecting three subspecies. These may be temporal subspecies in the sense of Mayr (1969: 43), reflecting evolutionary changes. However, some geographic variation may also occur, as discussed hereafter.

Oreohelix oterana ***oterana*** Metcalf, subspec. nov.

(Figures 1 and 2)

Description of Holotype: Shell relatively light in weight; 22.6 mm in diameter and 17.7 mm high; spire elevated, forming angle of 98° dorsally, rising 8.8 mm above terminus of upper lip; body whorl rounded peripherally and descending markedly to aperture; aperture 10.9 mm wide and 12.0 mm high with outer lip rounded,

aperture oriented at angle of 31° to vertical axis; umbilicus narrow, 3.5 mm wide, impinged upon slightly by expanding lip, contained 6.46 times in shell diameter; shell relatively loosely whorled with 5.25 whorls; sutures deeply impressed; whorls 1.5-2.7 with peripheral ridge adjacent to suture, produced by top of keel that is present on older whorls; first 1.5 whorls virtually smooth with very low, widely spaced growth lines, these becoming somewhat stronger on younger whorls, although shell is generally smooth; a faded brownish band occurs just below middle of body whorl, paralleled by a much narrower and dimmer band below and a slightly narrower band above on body whorl, this upper band continuing on, with interruptions, almost to beginning of whorl 3.

Variation: Variation in size and in some proportions of shells are indicated in Table 1. Development of the spire is especially variable. A few shells of adult *Oreohelix* ***oterana oterana*** show slight angulation of the body whorl, thus approaching the condition of *O. o. angularis,* described below. In some specimens as much as half the umbilicus is impinged upon by the lip. At maturity the lip becomes progressively thicker and callused.

Types: The type locality is Locality 10.

Holotype: USNM 809173.

Paratypes: (Topotypes) ANSP 352829, DMNH 5363, UA 19012, USNM 809172, UTEP 2242; (From other localities) UTEP 1736 (Loc. 4), 2081 (Loc. 12), 2166 (Loc. 9), 2232 (Loc. 14), 3875 (Loc. 13).

Oreohelix oterana ***angularis*** Metcalf, subspec. nov.

(Figures *3* and *4*)

Description of Holotype: Shell 21.9 mm in diameter and 15.0 mm high; moderately elevated, spire sub-pyramidal in outline dorsally, forming angle of 105° and rising 8.6 mm above level of terminus of upper lip; peripheral angularity present around middle of body whorl; aperture round, 10.1 mm wide and 10.2 mm high, oriented at angle of 45° to vertical axis; outer lip widened at angularity; umbilicus narrow, deep, 3.9 mm wide; contained 5.6 times in shell diameter; shell with 5.7 whorls; sutures not notably impressed; embryonic whorls with very fine growth wrinkles, which grade to stronger but still relatively low wrinkles on younger whorls; a few ridges in central part of whorls 2.0-2.75; outer margin of whorls 1.75-4.5 bordered by shallow furrow and ridge (peripheral to furrow and bordering suture) that represents top of (former) keel; color bands dim but discernible, the darkest (cinnamon brown) immediately below angularity on body whorl, below this on ventral surface are 5 exceedingly dim, interrupted color bands; a single dim band occurs on body whorl above angularity, continuing on to dorsal surfaces of other whorls but fading out on whorl 3.

Variation: Some shell dimensions and proportions are indicated in Table 1. A damaged specimen from Locality 5, not included in the table, has a diameter of 27.3 mm, largest specimen observed for the species. A sinistral specimen, 18.8 mm in diameter, was found at Locality 11 (Figure *4*). Height and dorsal angularity of the spire vary, with some specimens having markedly lower spires than the holotype (as in Figure *4*). As much as half of the umbilicus may be covered by the flaring lip. In some gerontic specimens the lip becomes heavily callused. Color bands, insofar as preserved, show much variation with interruptions and irregularities. From 1 to 7 brownish bands were observed below the angularity on the body whorl and up to 4 bands above the angularity.

Types: The type locality is Locality 5.

Holotype: USNM 809170.

Paratypes: (Topotypes) ANSP 352831, DMNH 5362, UA 19013, USNM 809171, UTEP 3426; (From other localities) UTEP 1691 (Loc. 7), 2230 (Loc. 8), 2233 (Loc. 11).

Oreohelix oterana ***lentiformis*** Metcalf subspec. nov.

(Figures *5* and *6*)

Description of Holotype: Shell heavy, 21.0 mm in diameter and 13.8 mm high; spire low, broadly triangular, forming angle of 110° dorsally and rising 8.3 mm above terminus of upper lip; strongly carinate, except for last 0.25 of body whorl where keel weakens, top of (former) keel forming ridge at periphery of all except first 1.25 whorls; last 0.1 of body whorl descending slightly to aperture; aperture round, except for angularity at position of keel in outer lip, 9.5 mm wide and 9.6 mm high, forming angle of 44° with vertical axis, lip thickened; umbilicus broad, 4.9 mm wide, contained 4.29 times in shell diameter; shell with 5.5 whorls, embryonic whorls smooth, except for faint growth wrinkles, these becoming moderately strong on younger whorls; a few microspiral ridges occur in central part of whorls 1.75-2.25; a pale brown band occurs on body whorl below keel and a still paler, inter-

rupted brown band occurs on dorsal surface of whorls 2.5-4.5.

Variation: Some shell measurements and proportions are indicated in Table 1. The spire is variable in height and varies greatly in degree of dorsal angulation. The peristome of gerontic specimens is much thickened, producing a thick columellar callus. Up to one-fourth of the umbilicus may be covered by the adjacent lip. As many as 5-8 faded brownish bands were observed below the keel on the body whorl. These bands exhibit considerable fusion and interruption, tending to form an especially broad band immediately below the keel. The dorsal surface of the embryonic whorls retains a brownish color in some specimens.

Types: The type and only locality is Locality 6.

Holotype: USNM 809174.

Paratypes: ANSP 352830, DMNH 5361, UA 19014, USNM 809175, UTEP 1776.

Etymologies: The epithet *oterana* refers to Otero County, New Mexico, in which most localities of the species occur. The subspecific names *angularis* (angular) and *lentiformis* (lens-shaped) refer to salient features of shell morphology.

Differential Diagnoses of Subspecies: The three subspecies grade from rounded and high-spired (*oterana*) to angular and moderately elevated (*angularis*) to carinate and low-spired (*lentiformis*). Only the earliest whorls of *oterana* exhibit carination, whereas the keel is maintained into sub-adult shells in *angularis* and into adult shells in *lentiformis*. Thus, in regard to carination, *lentiformis* might be regarded as paedomorphic. Specimens of *lentiformis* are generally smaller than those of the other subspecies (Table 1). Perhaps *lentiformis* inhabited an environmentally marginal habitat (cold?) conducive to dwarfing and paedomorphism. Sutures are more strongly impressed in *oterana* than in the other subspecies. Except for specimens of *oterana* from Locality 4, the umbilicus becomes progressively more open in the series *oterana-*

Table 1

Diameters (in mm) and shell proportions for fossil populations of three subspecies of *Oreohelix oterana* and of *Oreohelix strigosa nogalensis*. For each value, mean and standard deviation (in parenthesis) are shown above and range below. Each sample contains 20 shells. Localities (= Loc.) are arranged north to south within each taxon. (Apert. = Apertural; No. = Number of).

Taxon Loc. number	Diameter	Diameter/ Height	Height/ Apert. height	Apert. width/ Apert. height	Diameter/ No. whorls	Diameter/ Width of umbilicus
Oreohelix oterana oterana						
Loc. 4	21.3 (1.04)	1.34 (0.12)	1.56 (0.11)	0.95 (0.04)	3.93 (0.22)	4.04 (0.21)
	19.2-23.0	1.21-1.52	1.46-1.77	0.87-1.03	3.68-4.32	3.62-4.40
Loc. 9	20.4 (1.07)	1.35 (0.08)	1.45 (0.06)	0.96 (0.04)	4.02 (0.20)	4.67 (0.35)
	19.0-23.0	1.19-1.50	1.36-1.55	0.88-1.04	3.71-4.43	4.12-5.19
Loc. 10	20.9 (1.27)	1.33 (0.06)	1.51 (0.07)	0.95 (0.05)	4.05 (0.21)	4.83 (0.35)
	18.6-23.2	1.20-1.42	1.39-1.66	0.85-1.03	3.71-4.56	4.16-5.40
Loc. 14	19.9 (1.38)	1.34 (0.09)	1.49 (0.11)	0.95 (0.06)	3.80 (0.31)	4.98 (0.48)
	18.3-24.0	1.20-1.47	1.24-1.69	0.83-1.04	3.26-4.32	4.24-5.74
Oreohelix oterana angularis						
Loc. 5	23.0 (1.54)	1.25 (0.09)	1.55 (0.10)	0.96 (0.05)	4.08 (0.26)	4.08 (0.33)
	20.0-25.4	1.12-1.44	1.43-1.71	0.88-1.05	3.77-4.52	3.58-4.89
Loc. 11	20.8 (1.46)	1.47 (0.09)	1.41 (0.10)	0.95 (0.05)	3.87 (0.19)	4.03 (0.30)
	19.0-24.2	1.33-1.60	1.28-1.65	0.84-1.03	3.49-4.21	3.34-4.60
Oreohelix oterana lentiformis	19.2 (0.89)	1.73 (0.11)	1.43 (0.09)	1.07 (0.06)	3.72 (0.22)	3.87 (0.26)
	17.5-21.3	1.54-1.96	1.26-1.59	1.00-1.18	3.39-4.07	3.24-4.25
Oreohelix strigosa nogalensis	18.1 (1.34)	1.59 (0.11)	1.33 (0.07)	0.95 (0.04)	3.40 (0.22)	3.75 (0.16)
	16.1-20.6	1.42-1.86	1.19-1.48	0.88-1.02	3.04-3.79	3.45-4.09

angularis-lentiformis (Table 1). The pattern of color bands is similar in the three subspecies, although *lentiformis* exhibits a greater tendency towards fusion of bands on the ventral surface than do the others.

Embryonic shells have been preserved in matrix inside the parent shell in specimens from several localities and these are similar in the three subspecies. These embryonic shells show less evidence of weathering than older shells. Dorsally, the first 1.25 whorls are almost flat and bear a few, feeble growth wrinkles. A few microspiral ridges or cords (terminology of SOLEM, 1975: 17, 21) occur in the central and peripheral parts of whorls 1.5-3.0. These ridges are slightly more numerous (5-6) and stronger in *Oreohelix oterana lentiformis* than in the other two subspecies (3-4 ridges). The dorsal side of the keel is first evidenced between 1.25 and 1.75 whorls. In contrast to the sparse dorsal ornamentation, lirae are prominent on the embryonic shells, ventrally. In one embryo of *angularis* from Locality 5, 12 lirae were discernible, these being intersected at wide intervals by low growth lines.

Comparisons to Other Species: Three other species of *Oreohelix* are known from the Sacramento and White Mountains: (1) a small, discoidal species described in an accompanying paper (METCALF & CREWS, this volume); (2) *Oreohelix socorroensis* Pilsbry, 1905, known only as a fossil in the Sacramento Mountains and (3) *Oreohelix strigosa nogalensis* Pilsbry, 1939, which still inhabits the White Mountains, as at Localities 1 and 3, and has also been found as a fossil, as at Locality 2 (Figures 7 and 8).

Shells of *Oreohelix socorroensis* are smaller (generally less than 15 mm in diameter) than those of *O. oterana,* are strongly carinate, and exhibit strong lirae ventrally on all whorls.

Observations noted for *Oreohelix strigosa nogalensis* are based on fossil shells from Locality 2, which seem comparable, in their state of preservation, to shells of *O. oterana.* On shells of *O. strigosa nogalensis* there is no evidence of a keel on the earlier whorls such as that observed in *O. oterana.* Shells of *O. s. nogalensis* are more tightly whorled than those of *O. oterana.* Embryonic shells of *O. s. nogalensis* differ from those of *O. oterana* in having many close-set growth lines on the dorsal surface (Figure 8). More than 10 such lines occur in the first whorl. These lines are intersected by numerous, close-set microspiral ridges that cover the dorsal surface of whorls 0.75-2.5 (Figure 8). Sculpturally, these shells resemble the shell of *Oreohelix strigosa strigosa* (Gould, 1846) illustrated by SOLEM (1975: fig. 12). Ventrally, embryonic shells of fossil *O. s. nogalensis* from Locality 2 show 8 or 9 major lirae and numerous microspiral ridges between the lirae. These minute ridges were not observed on embryonic shells of *O. oterana.*

DISCUSSION

Lack of knowledge of the geology of the widespread Pleistocene deposits of the Sacramento Mountains hampers attempts to relate the oreohelicids discussed herein stratigraphically. Although widespread, sediments are exposed in few places and vary lithologically from valley to valley, reflecting local conditions of deposition.

Oreohelix oterana oterana occurs in what seem to be relatively ancient alluvial, reddish silts below valley-flanking terrace surfaces. The silts are of a massive nature and must represent a long period of Pleistocene deposition under rather uniform conditions. This subspecies has been found only along canyons dissecting the eastern slope of the Sacramento Mountains.

Oreohelix oterana angularis has been found in exposures mainly on the western slope of the mountains, except for its occurrence in the James Canyon drainage on the east slope (Locality 11 and elsewhere). It has been found at higher elevations than *O. o. oterana* and in some deposits of colluvial aspect, as at Locality 7.

Shells of *Oreohelix oterana lentiformis* have been found only at Locality 6 in upper Tularosa Canyon in colluvial hillslope deposits. Here it occurs with the similarly re-

Explanation of Figures 1 to 8

Figure 1: Holotype, *Oreohelix oterana oterana* Metcalf, subspec. nov.; USNM 809173; 22.6 mm diameter

Figure 2: Shell apex of *Oreohelix oterana oterana,* paratype from Locality 10 × 30

Figure 3: Holotype, *Oreohelix oterana angularis* Metcalf, subspec. nov.; USNM 809170; 21.9 mm diameter

Figure 4: Sinistral specimen of *Oreohelix oterana angularis* from Locality 11; 18.8 mm diameter

Figure 5: Holotype, *Oreohelix oterana lentiformis* Metcalf, subspec. nov.; USNM 809174; 21.0 mm diameter

Figure 6: Shell apex of *Oreohelix oterana lentiformis,* paratype from Locality 6 × 42

Figure 7: Fossil shell of *Oreohelix strigosa nogalensis* Pilsbry, 1939, from Locality 2; 17.9 mm diameter

Figure 8: Shell apex of *Oreohelix strigosa nogalensis* from Locality 2 (fossil) × 40

Figure 1

Figure 2

Figure 3

Figure 4

Figure 5

Figure 6

Figure 7

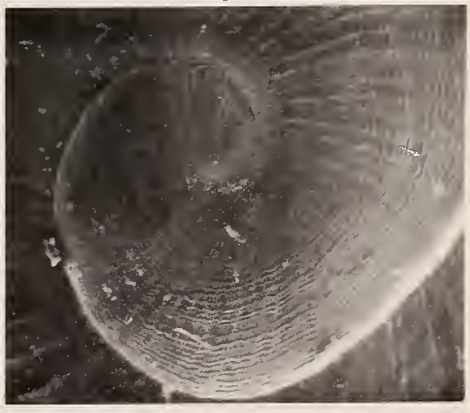

Figure 8